PREVENTING HARM FROM CENTRAL LINE-ASSOCIATED BLOODSTREAM INFECTIONS (CLABSI)

Cynosure Health

CHANGE PACKAGE

HOW TO USE THE CLABSI CHANGE PACKAGE

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HOW TO USE THIS CHANGE PACKAGE

ABOUT CYNOSURE

Cynosure Health is a nonprofit organization that works with diverse stakeholders to accelerate spread, implementation, and sustainable improvement in healthcare quality. Although our work spans multiple sectors in topics such as collaborative learning and care management, we specialize in working with hospitals, clinicians, health systems, and community-based coalitions on federal and statewide initiatives, regional collaboratives, and local partnerships.

For two decades, the Cynosure team has done pioneering work to improve outcomes, and we're committed to fostering innovative solutions to health care's toughest challenges.

ABOUT THIS CHANGE PACKAGE

Change Packages developed by our team of experts are tools to translate evidence into action, to help health care improvement teams make patient care safer and improve outcomes. In this Change Package, you will find best practices and ideas to test from other high performing health organizations. It was developed with contributions from subject matter experts, literature review, and sharing from health care organizations that have successfully implemented the identified practices. This change package helps to translate the evidence into a menu of strategies, change concepts and specific actionable items that any hospital can implement based on need or for purposes of improving patient quality of life and care.

Cynosure Health Change Packages are organized around a topic-specific Driver Diagram. Driver Diagrams are utilized to identify, organize, and prioritize improvement activities. Each primary driver for improvement in this Change Package has accompanying Ideas to Test for hospitals seeking to improve outcomes.

Cynosure HEALTH

PART 1: DEFINITION AND SCOPE

Current definition of harm topic: Hospital-associated central line-associated bloodstream infections (CLABSI) are serious but preventable infections when evidence-based guidelines for central line insertion and maintenance are properly prioritized and implemented.[1]

MAGNITUDE OF THE PROBLEM

Central lines are life saving devices. They enable us to administer large volumes of fluids and medications to patients who might otherwise not improve or survive. However, these critical devices can also result in significant harm when they become the source of a bloodstream infection and/or sepsis.

CLABSIs result in increased length of hospital stay, increased cost and increased patient morbidity and mortality. An estimated 30,100 CLABSIs occur in U.S. ICUs each year.[2] Patient mortality rates associated with CLABSIs range from 12 to 25 percent[3] and the cost of CLABSIs per episode of care ranges from $3,700 to $36,000.[4]

Between 2008 and 2013, the adoption and implementation of evidence-based practices was associated with an impressive 46 percent reduction in CLABSIs.[5] Leveraging this improvement, further efforts are needed to prevent patient harm, especially in noncritical care settings including hemodialysis centers and inpatient wards. As the majority of CLABSIs occur outside the ICU[1], the maintenance, application and spread of ICU improvement successes are necessary to realize safety goals across patient populations.

There was an approximate 7% decrease reduction in the US between 2018 and 2019. The largest decrease was observed in NICU's. Reference: 2019 National and State Healthcare-Associated Infections (HAI) Progress Report.

It is not surprising that the percentage of improvement is shrinking since many of the practices that impacted the 2013 data have been hardwired. We do need to stay focused and continue to apply standardized prevention strategies that have demonstrated an impact and reduction of CLABSIs.

Fortunately, CLABSI prevention strategies are applicable to both critical and noncritical care settings. The CLABSI central venous catheter (CVC) insertion bundle includes: procedural pause, hand hygiene, aseptic technique, optimal site selection, chlorhexidine for skin preparation and maximal sterile (full-barrier) precautions.[6] The CLABSI maintenance bundle includes central line site dressing changes, administration tubing changes, IV fluid changes and daily review of line necessity with timely removal.[1]

PART 2: MEASUREMENT

A key component in making patient care safer in your hospital is to track your progress toward improvement. Collecting data points at your hospital will guide your quality improvement efforts as part of the Plan-Do-Study-Act (PDSA) process. Tracking your data in this manner will provide valuable information needed to study your data across time and help determine the impact of your improvement initiatives on reducing patient harm.

NATIONALLY RECOGNIZED MEASURES: PROCESS AND OUTCOME

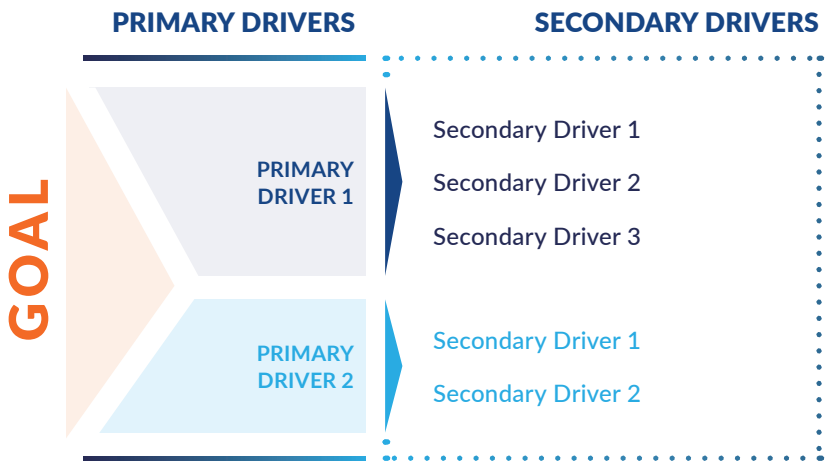
- CLABSI standardized infection ratio (SIR) (NQF 0139) reported for
  - ICU units, including NICU
  - ICU and other units
- Central line utilization ratio (central line days/patient days) * 100
- CLABSI rates (CLABSIs per 1,000 central line days, CLABSIs per 10,000 patient days) reported for
  - ICU units, including NICU
  - ICU and other inpatient units

PART 3: HOW TO IMPROVE

INVESTIGATE YOUR PROBLEM AND IMPLEMENT BEST PRACTICES

Driver Diagrams

A driver diagram visually demonstrates the causal relationship between change ideas, secondary drivers, primary drivers and your overall aim. A description of each of these components is outlined in the table below. This change package is organized by reviewing the components of the driver diagram to (1) help your care team identify potential change ideas to implement at your facility and (2) show how this quality improvement tool can be used by your team to tackle new process problems.



Suggested bundles and toolkits

Institute for Healthcare Improvement (IHI) How-to Guide: Prevent Central Line-Associated Bloodstream Infection

Agency for Healthcare Research & Quality (AHRQ) Tools for Reducing Central Line-Associated Blood Stream Infections

Centers for Disease Control and Prevention (CDC) Guidelines for the Prevention of Intravascular Catheter Related Infections, 2011

AIM: A clearly articulated goal or objective describing the desired outcome. It should be specific, measurable and time-bound.

PRIMARY DRIVER: System components or factors that contribute directly to achieving the aim.

SECONDARY DRIVER: Action, interventions or lower-level components necessary to achieve the primary driver.

CHANGE IDEAS: Specific change ideas which will support or achieve the secondary driver.

DRIVERS IN THIS CHANGE PACKAGE

GOAL PREVENT CLABSI

PRIMARY DRIVERS	SECONDARY DRIVERS
STANDARDIZE INSERTION PROCESS	Implement insertion checklist. Implement "stop the line". Optimal site and device selection. Ultrasound guidance for line placement. Hand hygiene, aseptic technique. Prep with 2 percent CHG.
REVIEW LINE NECESSITY DAILY	Review line necessity daily.
STANDARDIZE MAINTENANCE PROCESS	Bundle together elements. Incorporate into daily assessment. Scrub the hub. Blood culture collection.
SPECIALIZE TACTICS: BEYOND THE BUNDLES	Use CHG dressings. Bathe with CHG. Use a non-suture securement. Use antimicrobial-impregnated CVCs. Do not routinely replace CVCs. Involve patients and families.

Driver 1 STANDARDIZE INSERTION PROCESS (INSERTION BUNDLES)

Following established guidelines for central venous catheter (CVC) insertion will decrease CLABSI rates.[7,8,9] All units should adopt and implement this evidencebased insertion bundle.[10,11] The insertion bundle includes: indications for CVCs, maximal sterile barrier precautions, aseptic technique, hand hygiene, proper skin prep, and correct insertion technique.

SECONDARY DRIVERS IN THIS SECTION

1. **Implement an insertion checklist.**
2. **Implement "stop the line".**
3. **Optimal site and device selection.**
4. **Ultrasound guidance for line placement.**
5. **Hand hygiene, aseptic technique.**
6. **Prep with 2 percent CHG.**

1. Insert catheters only for appropriate indications.

An insertion checklist can help ensure that all recommendations for insertion of a CVC are followed each time. The checklist includes a list of actions that should occur before (e.g., procedural pause), during (e.g., skin prep with 2 percent chlorhexidine gluconate (CHG) and after (e.g., appropriate site dressing) CVC insertion.[12,13] Use of a checklist is an effective approach to ensure patients are receiving appropriate care. See **Appendix II** for an example of CVC insertion checklists.

Change Ideas

- Adopt and use a CVC insertion checklist using the following guidelines:
  - Engage staff nurses to adopt and adapt a CVC insertion checklist to promote patient safety
  - Enlist the medical director or other provider champion to support the use of the checklist and to educate and mentor providers
  - Determine who will complete the insertion checklist at the time of insertion: the nurse assisting, an independent nurse observer, or a technician
  - Determine what is to be done with the paper or electronic checklist after it has been completed for tracking of compliance to the insertion bundle (e.g., could be sent to infection prevention manager or CLABSI prevention champion)

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance of insertion bundle guidelines.

2. Implement “stop the line”.

A checklist ensures best practices for CLABSI reduction are followed. It is important to create a safe process for staff to speak up if a violation of infection prevention practices is observed during a central line insertion. Staff and providers must work together to ensure that all aspects of the checklist are instituted with every patient. If a break in practice occurs, the procedure should be halted and corrections must be made. Corrections could include changing a contaminated glove, replacing the guide wire or using a full body drape instead of a short drape. Successful implementation of a checklist requires effective interpersonal communication skills and can give staff an opportunity to learn teamwork skills experientially.

Change Ideas

- Adopt policies that combine individual accountability with a blame-free, patient-centered approach to errors.
- Use the medical director or another provider champion to support the "stop the line" approach and communicate the value to other providers.
- Create a process, with staff, to "stop the line." Scripting can be helpful. One hospital's staff adopted the phrase "the sterile field has been contaminated" to be uttered by the nurse or technician auditing the process.[14]
- Determine specific incidents that prompt the staff to "stop the line," (e.g., not everyone in the room is wearing maximal barrier precautions, there is a break in the sterile field, a full-body drape is not being used or proper skin prep has not been done.)
- Develop a strategy in your clinical area to support the staff who "stop the line," (e.g., what to do if a violation is identified and if the provider fails to correct the violation.) Possible options could include paging the unit nursing director or medical director to intervene.
- Ensure policies and processes are in place for use of the checklist and "stop the line."
- Executive support for staff "stopping the line" is needed before and after breaches in policies occur
- Consider TeamSTEPPS® training to support crucial communication and teamwork.[15]

3. Optimal site and device selection.

Research data suggest that certain CVC sites may have a lower risk of infection.[16,17,18,19,20,21] The current CDC/NHSN and SHA/IDSA practice recommendation is to avoid using the femoral vein for central venous access in adult patients.[22,23,24,25] The subclavian site may be superior to the jugular site in terms of CLABSI risk; however, other risks associated with the subclavian site must be considered (e.g., pneumothorax). Site selection is based on patient need and risks, and some new evidence suggests the femoral site is not as prone to risk of infection as once reported. If the femoral site is used, site prep and line maintenance done according to guidelines are vitally important. Consider alternatives to central lines when clinically indicated such as midline catheters or longer dwell-time peripheral intravenous catheters.

Change Ideas

- Include site selection as an item on insertion checklist.
- Promote documentation of rationale for use of femoral site if it is selected for CVC placement.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with appropriate CVC insertion site selection.

4. Ultrasound guidance for line placement.

The use of ultrasound (US) to guide insertion may reduce the risk of iatrogenic harm and increase accuracy of line placement. Studies have demonstrated that, as compared to the technique of using landmarks, US guidance in placement of CVC in adults and children decreases the number of anatomical sites utilized and decreases the number of attempts to achieve successful placement.[26,27,28] US guidance may therefore decrease patient discomfort, risk of harm and time to successful CVC placement, and may increase compliance with insertion guidelines. US guidance may encourage the use of the subclavian or internal jugular entry site versus the femoral site because it reduces the risk of iatrogenic pneumothorax and other complications.

Change Ideas

- Ask the lead physician to host in-services and provide continuing medical education (CME) credit on the use and benefit of using ultrasound for CVC placement. Include hands-on practice for physicians attending. Follow state and hospital credentialing for physician use of ultrasound guidance for line placement. Education and demonstrated competency will be required.
- Have the physician champion and other early adopters promote the use of ultrasound guidance.
- Partner with your infection prevention practitioner when introducing US-guided CVC placement.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percentage of central lines placed with ultrasound guidance.

5. Follow recommended practices for hand hygiene, aseptic technique and maximal sterile barrier precautions.

Establish a process to ensure appropriate practices for hand hygiene, aseptic technique, and maximal sterile barrier precautions are followed. Hand hygiene continues to be an integral part of any infection prevention program.[29,30] Following aseptic technique for insertion and care is crucial to prevent CLABSI. Aseptic technique includes using maximal sterile barrier precautions such as a cap, mask, sterile gown, sterile gloves, and a sterile full-body drape during insertions of CVCs and PICCs or during guide wire exchange.[31]

Change Ideas

- Provide easy access to hand hygiene agents such as conventional soap and water or alcohol-based hand sanitizers to facilitate hand hygiene before and after each procedure.
- Have supplies and equipment easily available, e.g., a central line insertion kit with maximal barrier precaution supplies, central line dressing kits, and administration sets. Consider enlisting staff to help build an insertion kit or line cart and to keep it stocked.
- Include hand hygiene and maximal barrier precautions as part of a CVC insertion checklist.
- Package CVC, skin antiseptic, and maximal barrier precautions in insertion kits to make it easier for providers to follow recommended guidelines.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with maximum barrier drape.
- Percent compliance with hand hygiene prior to CVC insertion.

6. Skin prep with 2 percent chlorhexidine (CHG).

The preferred agent for skin antisepsis before catheter insertion and during dressing changes is two percent chlorhexidine (2 percent chlorhexidine in 70 percent isopropyl alcohol) unless the patient is allergic to chlorhexidine or under two months of age.[32,33]

Change Ideas

- Include two percent CHG swabs in the CVC insertion kits and on the CVC line cart
- Include skin prep with two percent CHG as an item on the insertion checklist

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with use of CHG skin prep.

Hardwire the Process

Hardwiring tactics for the central line insertion bundle includes many of the change ideas. Ongoing monitoring of compliance to insertion guidelines is vital to sustain recommended practices.

- Engage staff and providers in the design and development of tools and support systems such as an insertion checklist and a CVC line cart.
- Attach the checklist to the central line insertion kit for easy access.
- Implement the use of an insertion checklist and empower the designated observers to enforce use of the checklist and adherence to recommended insertion practices.
- Audit compliance and provide feedback to providers regarding the audit results and recommendations for improvement. Report results regularly in quality or infection prevention committees. If compliance to insertion guidelines decreases, engage practitioners and nurses to examine contributing factors, barriers, and potential changes.

Driver 2 DAILY REVIEW OF LINE NECESSITY

One of the most effective strategies for preventing CLABSIs is to eliminate or reduce exposure to CVCs. The decision regarding the need for a central line is complex, however, and difficult to standardize or incorporate into a practice guideline. Nevertheless, to reduce exposure to CVCs, the multidisciplinary team should adopt a strategy to systematically evaluate on a daily basis whether all central lines remain necessary or can be removed.[34,35]

SECONDARY DRIVERS IN THIS SECTION

1. **Daily review of line necessity.**

1. Daily review of line necessity.

Current CDC and SHEA/IDSA practice guidelines recommend daily review of line necessity and prompt removal of the line when no longer necessary.[36,37]

Change Ideas

- Combine daily review of line necessity with other best practice reviews such as daily urinary catheter review. Line necessity is determined by a patient's clinical needs.
- Incorporate daily review into routine workflow, such as charge nurse rounds or daily multidisciplinary rounds.
- Include an infection preventionist as part of rounds. He or she can help support line necessity review.
- If using an electronic practice management system, institute computer-based pop-up reminders to review line necessity.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with daily review of the necessity for a central line.

Hardwire the Process

To hardwire daily review of line necessity, make the process a part of the daily workflow. Do small tests of change with staff to determine the best implementation process. Methods for hardwiring include:

- Adding daily review of line necessity as a standing item in nurse-to-nurse handoff reports.
- Auditing daily line review compliance and providing feedback to the care team. If compliance is low, ask why, and engage staff in identifying problems and refining the process of daily review.
- Assigning responsibility for daily line necessity and documentation to the primary care provider.

Driver 3 STANDARDIZE THE MAINTENANCE PROCESS

The bundle approach provides a means to incorporate evidence-based interventions into patient care. Adopt and embed evidence-based guidelines (bundle) for CVC maintenance after insertion across care settings. Because a significant proportion of central line days and CLABSIs occur in non-ICU settings, it is important to include them in the maintenance process implementation.[38] Implementation of a post-insertion care bundle in addition to an insertion bundle has been shown to be effective in reducing CLABSI.[39]

Current recommendations for most CVCs from CDC/NHSN guidelines and SHEA/IDSA 2014 practice recommendations include:

1. Use sterile, transparent, semipermeable dressing (or sterile gauze) to cover the catheter site.
    - Replace site dressing every seven days (every two days if made of gauze) or if it becomes loose, soiled, or damp.
    - Use of topical antibiotic ointment or creams is not recommended unless the line is a dialysis catheter.
2. Replace administration tubing at intervals of less than 96 hours.
    - See CDC guidelines regarding blood products, fat emulsions, etc.[40] Establish and implement facility guidelines for intravenous fluid administration bag changes. For further details, please see the actual guidelines referenced above as "Key Resources."

SECONDARY DRIVERS IN THIS SECTION

1. **Bundle together elements.**
2. **Incorporate into daily assessment and review.**
3. **Scrub the hub.**
4. **Blood culture collection.**

1. Bundle together elements.

Change Ideas

- Have supplies and equipment stored together and easily available, (e.g., central line dressing kits, chlorhexidine dressings, IV fluid infusion bags, and administration sets.)
- Assign dressing change responsibility to a core group of individuals who are highly trained and competent (e.g., the PICC team).
- Have supplies for accessing IV tubing and ports together and easily available, (e.g., chlorhexidine, povidone iodine, an iodophor or 70 percent alcohol, and alcoholimpregnated caps for unused ports.)
- Establish a specific day of the week for line changes, (e.g., every Wednesday.)

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with site dressing done according to standard.

2. Incorporate into daily assessment and review.

Incorporate a daily review of the maintenance bundle to ensure that dressings, administration tubing, and IV fluid are current and not expired. If any missing element is found during the review, establish a process to correct the missing element.

Change Ideas

- Perform maintenance bundle review along with daily line necessity review. Items to review can be included in the charge nurse's checklist. If the bedside nurse has not had time to change the dressing or administration tubing, for example, the charge nurse can delegate the task to another nurse.
- Develop a process to ensure CVC maintenance is completed as needed.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with maintenance bundle of individual bundle elements.
- Percent compliance of all-or-none bundle element.
- See Appendix III for an example of a CVC maintenance audit or monitoring tool.

3. Scrub the hub.

Before accessing the line, disinfect catheter hubs, needleless connectors, and injection ports.[41] SHEA/IDSA 2014 practice recommendations state to scrub the hub with a CHG preparation or 70 percent alcohol combination for a minimum of five seconds.[42,43,44] See **Appendix IV** for a Scrub the Hub flyer.

Change Ideas

- Incorporate use of antiseptic impregnated caps for all central line ports. This minimizes the need to scrub the hub.[45]
- Have supplies for disinfecting line access sites easily available, (e.g., IV carts, medication carts.)

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with scrub the hub prior to accessing line.

Hardwire the Process

Strategies to hardwire catheter maintenance and maintenance bundle compliance are similar to those used for insertion bundle and daily line necessity reviews. Hardwiring should be included in the initial planning and testing. Making the implementation and review processes as routine as possible will ensure that CLABSI prevention is addressed in every patient with a CVC in any care area.

- Incorporate daily maintenance bundle item review along with line necessity review into the daily workflow.
- Include bundle review as a standing item in nurse-to-nurse handoff reports. Enlist all shifts (24/7) in reducing risk of harm by implementing the guidelines and performing necessary tasks such as dressing changes.
- Review central line care and maintenance with staff upon hire and at least annually and assess staff competency in this arena.
- Audit maintenance care compliance and provide feedback to the care team. If compliance is low, ask why, and engage staff in identifying problems and refining the process of implementation and review.
- Incorporate daily rounds to have staff identify the presence of invasive devices such as central lines and urinary catheters (often referred to as “plastic rounds”).

4. Blood culture collection.

Increase the accuracy of CLABSI identification and treatment by optimizing best practice in the collection, handling, and management of blood culture specimens.

Change Ideas

- Make the right thing the easy thing by preassembling peripheral blood culture collection supplies to promote best practices.
- Review blood culture collection practices with staff to assure reliabilty of practices.
- Explore the use of a peripheral blood culture technology that reduces blood culture contamination through initial specimen diversion.[46]

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Make the right thing the easy thing by preassembling peripheral blood culture collection supplies to promote best practices.
- Review blood culture collection practices with staff to assure reliabilty of practices.

Hardwire the Process

Blood culture draws from central lines are perceived as "better" for the patient as they don't require a peripheral stick. Educate staff to assure they understand that there have been nine studies that demonstrated a higher blood culture contaminate rate when blood was drawn from a central venous catheter.[47,48]

- Consider drawing venipunture samples on the opposite extremity of an infusion.
- Assure optimal aseptic technique during blood culture collection.

Driver 4 SPECIALIZE TACTICS: BEYOND THE BUNDLES

Additional strategies are recommended to further reduce CLABSI rates if the rates remain unacceptably high after implementation of basic CLABSI prevention strategies. More research has emerged on the use of CHG dressings and CHG-containing sponge dressings, CHG bathing, the use of nonsuture securement devices, the use of antimicrobial-impregnated CVCs for adult patients, and ultrasound guidance to place lines. Both SHEA/ IDSA and CDC/ NHSN guidelines also recommend against routine replacement of CVCs.[49,50]

SECONDARY DRIVERS IN THIS SECTION

1. **Use of chlorhexidine (CHG)-containing dressings.**
2. **CHG bathing.**
3. **Use a nonsuture securement device.**
4. **Antiseptic- or antimicrobial-impregnated CVCs for adult patients.**
5. **Do not routinely replace CVCs.**
6. **Patient and family engagement: involve patients and families in infection prevention practices.**

1. Use of chlorhexidine (CHG)-containing dressings.

Apply CHG-containing sponge dressings directly to the insertion site (encircle the catheter itself) for temporary short-term catheters under a transparent dressing.[51,52,53] Also emerging as a recommendation for catheter sites is the use of a transparent dressing with infused CHG that covers the site.[54]

Change Ideas

- Include CHG dressing use in staff trainings on CVC site care and maintenance and assess staff understanding and competency.
- Include CHG-infused sponge dressings or CHG dressings in the dressing kit or supplies.
- Review the use of CHG dressing sponges daily as part of the maintenance bundle review.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with CVC dressing changes.

2. CHG bathing.

Daily bathing with CHG has been shown to reduce the incidence of health care associated bloodstream infections and is now a recommended practice as an additional intervention.[55,56,57,58] CHG bathing reduces the bio-burden on the patient's skin and thereby reduces the risk of CVC site infection and CLABSI. Bathe patients older than two months of age daily with two percent CHG.[59,60]

Change Ideas

- Include CHG bathing as part of staff central line care and maintenance training and assess staff competency.
- Have two percent CHG-saturated cloths easily available to staff.
- Incorporate use of two percent CHG cloths for daily skin cleansing into the daily workflow such as nurse's aides' delivery of daily hygiene care.
- Incorporate CHG skin cleansing daily as part of the maintenance bundle review.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with daily CHG bathing and bathing technique.

3. Use a nonsuture securement device.

The use of a nonsuture securement device reduces the risk of infection at the CVC site and is included in the CDC/NHSN guidelines.[61]

Change Ideas

- Include a nonsuture device in the CVC insertion kits. Do not include sutures in the kit. Work with the supplier or assembler of the insertion kits to include all needed supplies.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with nonsuture securement device.

4. Antiseptic- or antimicrobial-impregnated CVCs for adult patients.

Use a CVC impregnated with CHG/silver sulfadiazine or minocycline/rifampin in patients whose catheter is expected to remain in place for more than five days (contraindicated if the patient is allergic to the impregnated substance). Use of antimicrobial-impregnated CVCs can also be an additional strategy to reduce CLABSI rate in facilities with continued high CLABSI rates after the implementation of insertion and maintenance bundles.[62,63] Consider the use of these CVCs in other situations, such as for inpatients with limited venous access and a history of recurrent CLABSI and for patients who have increased risk for severe sequelae from a CLABSI (e.g., patients with recently implanted intravascular devices).[64]

Change Ideas

- Test the use of an antiseptic- or antimicrobial-impregnated CVC in patients whose CVC is expected to remain in place for more than five days.
- Include an antiseptic- or antimicrobial-impregnated CVC as an option for placement in the CVC line cart.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with antiseptic- or antimicrobial-impregnated CVC in appropriate patients.

5. Do not routinely replace CVCs.

Routine replacement of CVCs is NOT recommended by either CDC/NHSN guidelines or SHEA/IDSA. CVCs including PICCs should not be removed on the basis of fever alone.[65] CDC/NHSN recommends that physicians use clinical judgment regarding the appropriateness of removing the CVC if infection is evidenced elsewhere or if a noninfectious cause of fever is suspected.[66] CDC/NHSN guidelines also caution against the use of routine guide wire exchanges to prevent infection and to replace a catheter suspected of infection.

Change Ideas

- Incorporate into policy the recommendation that CVCs are not to be replaced routinely.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with daily CHG bathing and bathing technique.

6. Patient and family engagement: involve patients and families in infection prevention practices.

Educate patients and families on all the steps being taken to prevent central line infection using a teach-back method. Patient and family education should include the purpose of a central line, expected duration of use, and why it is important to remove it as soon as it is no longer clinically indicated.

Change Ideas

- Educate the patient and his or her family or caregivers about what they can do to help prevent a central line infection, e.g., invite the patient and the family to remind health care providers to wash their hands and to ask each day if the central line continues to be necessary.
- Make available to patients and families educational material on central lines, such as the CDC's FAQs About Catheter-Associated Bloodstream Infection.

SUGGESTED PROCESS MEASURES FOR YOUR TEST OF CHANGE

- Percent compliance with documentation of patient and family education.

Hardwire the Process

Hardwiring is key to sustaining change. Making it easy for caregivers to do the right thing is a cornerstone hardwiring strategy. Be sure to include staff on the decision making of the design process.

- Bundle CHG dressings with other needed items into a CVC dressing kit.
- Store CHG bathing cloths in a place easily accessible to staff.
- Elicit feedback from patients and families on not only the care received but also the support they received from communication and education.

PDSA IN ACTION
TIPS ON HOW TO USE THE MODEL FOR IMPROVEMENT

Choice of Tests and Interventions for CLABSI Reduction:

- Implement the CVC maintenance bundle and line necessity review one unit at a time.
    - Engage front-line staff from the beginning on process design and on the adoption and adaptation of procedures.
    - Consider testing maintenance bundle and line necessity in non-ICU settings.

IMPLEMENT SMALL TESTS OF CHANGE

PLAN

- Do not reinvent the wheel. Pick a daily review tool that has been successful at another hospital and adapt it for your facility. See appendices III and IV for examples.
- Engage front-line staff in designing the implementation process, (e.g., the day shift charge nurse on morning rounds will review maintenance bundle items and line necessity with the bedside nurse.)
- Ask a receptive, early-adopter bedside nurse and charge nurse to test these changes on their next patient with a CVC.

DO

- Test "small:" one charge nurse, one bedside nurse, one patient with a CVC, one shift.
- Coordinate with the trial nurses to begin the daily review of the maintenance bundle and line necessity with one patient.

STUDY Debrief as soon as possible after the test with those involved, asking:

- What happened?
- What went well?
- What didn't go well?
- What do we need to do differently next time?

ACT

- Do not wait for the next committee meeting to make changes. Revise the procedures and re-test as soon as possible with the same bedside nurse and charge nurse.
- Grow the second test to include all patients on one unit on one shift and additional bedside nurses.

COMMON CHALLENGES TO IMPROVEMENT

- Assess for practice drift periodically even if your rates are low. Engage with staff to discuss any barriers to full implementation of the insertion and maintenance bundles.
    - Do a spot check to determine bundle compliance for each element by checking five patients with CVCs (including PICCs). Spot-check questions include:
        1. Were all of the insertion bundle elements completed?
        2. Is the site dressed according to the guidelines, is the dressing current, and is the CHG sponge applied correctly?
        3. Is the administration tubing current?
        4. Was the CVC assessed daily for necessity?
- Recognize that there may be some pushback from physicians regarding changing practice.
    - Engage a physician champion to support your change efforts.
    - Listen to physicians' feedback and engage them in process design and equipment and supply selection.
    - Begin implementation with early-adopter physicians who can lead and recruit other early-adopter champions from among specialty groups and intensivists.
    - Despite the research evidence showing benefits from these guidelines, some physicians may be reluctant to wear a cap or other items required for maximal barrier precautions. One hospital approached this challenge by discussing the research evidence and the pros and cons of the recommendations with the medical director of the ICU. The value of complying with the recommendations was emphasized. After the medical director and other early-adopter champions modeled the new practices, the rest of the medical staff agreed to adopt the evidence-based recommendations as well.

- Nurses may feel uncomfortable with "stopping the line" for an observed violation of infection control practices and physicians may feel their credibility and authority is being challenged when a break in technique is called out. To address these concerns:
  - Both physician and nursing leadership need to be visible and to communicate the expectations of adherence to the insertion bundle. They can coach staff on the importance of consistency in procedure implementation and on how to "call a halt" or "stop the line."[67]
  - Invite senior or unit-level leadership to meet with nursing and physician staff to emphasize that the focus is on teamwork to promote patient safety and improve patient outcomes.
  - Develop an algorithm for the observer to follow if a "stop the line" intervention is resisted. For example, the observer could page the unit director 24/7 to intervene.
  - Audit the percentage of CVC insertions that had the checklist properly completed. Calculate the rates of compliance with evidence-based practice and the number of corrections required. Make the results known to providers and enlist the providers in developing methods for improvement.

SOLUTIONS

Enlist administrative leadership as sponsors to help remove or mitigate barriers

- Enlist an executive sponsor who recognizes the value of preventing CLABSI to the organization and your patients. The sponsor can help engage key stakeholders, the board, and staff in seeing the big picture of the importance of eliminating harm caused by CLABSI.
- The sponsor must have the authority and ability to provide solutions in overcoming barriers and resources needed to facilitate implementation.
- Utilize respected senior physicians as "opinion leaders" who can test these changes in their local units, and then advocate for organization-wide adoption of successful best practices.

Change not only "The Practice," but also "The Culture"

- Instituting the CLABSI insertion and maintenance bundles will require a change in culture, particularly among physicians, who will be asked to evolve their practice of individualizing management for each patient toward a more standardized, multidisciplinary approach. Physicians may be concerned about the perceived risks of loss of control and shared responsibility. Encourage physicians to actively monitor the effectiveness of these multidisciplinary interventions to reduce CLABSI rates.
- Many physicians prefer to learn from peers rather than by following theoretical "expert advice." Use lead physicians as peer educators to advocate for the adoption of improvements such as a CVC insertion bundle and to model the new practices.
- Begin the trial with a small test of change in one unit or area and then disseminate successful results more widely across the organization. The ideal outcome is the development of team-based care wherein each member of the team (physician, nurse, technicians) contributes to improved quality of patient care.

CONCLUSION & ACTION PLANNING

CLABSI prevention is complex and challenging. However, there are many evidence-based strategies and tools to use to reduce CLABSI. This effort requires a multidisciplinary approach that includes physicians, leaders, and front-line staff. Continual monitoring of compliance to bundles assists in data-driven decision making. Utilizing data to drive practice and process changes as well as communication to clinical staff on bundle performance and CLABSI rates is imperative.

- **Multidisciplinary approach:** Assemble a team with physician champions, front-line staff leaders, and key leadership persons. Determine and define roles that the leader has the energy to lead a dynamic process improvement project. Assess the composition of the team and the support from key strategic partners such as the quality leader, chief medical officer, nursing director, infection prevention, etc. Create strategies and/or allocate resources to engage front-line staff in designing new care processes.
- **Ongoing monitoring:** Use the data to drive decision making for determining practice and process changes. Use the Top Ten Checklist (Appendix I) to assess current efforts in CLABSI prevention. Ask, "Do we have this element in place? If so, how well are we doing it? Have we had practice drift?" Enlist physician and nursing champions on the team to assist in data analysis, determine potential interventions and conduct small tests of change.
- **Communication:** Establish clear lines of communication with physicians, staff, other stakeholders, and supporting leadership. Communication should include bundle compliance performance, CLABSI rates, and annotated with interventions to show effect of improvement efforts.

PART 5: APPENDICES

APPENDIX I:
CLABSI TOP TEN CHECKLIST

Purpose of Tool: A checklist to review current or initiate new interventions for CLABSI prevention in your facility.

1. Implement the insertion bundle: Procedural pause, hand hygiene, aseptic technique for insertion and care, site selection of subclavian (preferred) or internal jugular (acceptable), avoidance of femoral vein in adults, maximal sterile precautions, and skin prep with two percent chlorhexidine.
2. Implement an insertion checklist to promote compliance and monitoring.
3. Implement a "stop the line" approach to the insertion bundle. If there is an observed violation of infection control practices (e.g., maximal sterile barrier precaution, break in sterile technique), line placement should stop and the violation should be corrected.
4. Adopt the maintenance bundle with dressing changes (every seven days for transparent dressings), line changes, and IV fluid changes. Incorporate dressing changes into daily assessment and review. Can be part of charge nurse's checklist along with the daily review of line necessity.
5. Incorporate a daily review of line necessity and maintenance bundle into workflow (e.g., charge nurse rounds). Use an electronic health care record prompt.
6. Use a chlorhexidine impregnated sponge dressing.
7. Use two percent chlorhexidine impregnated cloths for daily skin cleansing.
8. Do not routinely replace CVCs, PICCs, hemodialysis catheters, or pulmonary artery catheters.
9. Use a suture-less securement device.
10. Use ultrasound guidance to place lines if this technology is available.

APPENDIX II:
CENTRAL LINE PROCEDURAL CHECKLIST

Associated Hospital/Organization: CDPH Public Health.

Purpose of Tool: To document procedural practices related to insertion technique for central lines.

Reference: Healthcare-Associated Infections Program Adherence Monitoring Central Line Insertion Practices

Healthcare-Associated Infections Program Adherence Monitoring
Central Line Insertion Practices

Assessment completed by:
Date:
Unit:

Regular monitoring with feedback of results to staff can maintain or improve adherence to central line insertion practices. Use this tool to identify gaps and opportunities for improvement. Monitoring may be performed in any type of patient care location where central lines are inserted.

Instructions: Use this tool to **directly observe** *central line insertions*. Observe each practice and check a box if adherent, Yes or No. In the column on the right, record the total number of "Yes" for adherent practices observed and the total number of observations ("Yes" + "No"). Calculate adherence percentage in the last row.

Practices denoted with an asterisk (*) are considered core strategies and should be correctly practiced for each line insertion.

	Central Line Insertion Practice	Patient/ Resident 1		Patient/ Resident 2		# Yes	# Observed
IP1.	Line necessity is indicated (based on evidence-based indications list).	☐ Yes	☐ No	☐ Yes	☐ No		
IP2.	Central line insertion date and indication are documented at the time of insertion.	☐ Yes	☐ No	☐ Yes	☐ No		
IP3.*	Hand hygiene is performed before **and** after insertion.	☐ Yes	☐ No	☐ Yes	☐ No		
IP4.*	Maximum barrier precautions are used for insertion.	☐ Yes	☐ No	☐ Yes	☐ No		
IP5.*	The optimal site is selected, avoiding the femoral site in adult patients.	☐ Yes	☐ No	☐ Yes	☐ No		
IP6.*	Greater than 0.5% chlorhexidine (CHG) with alcohol is used for skin antisepsis prior to insertion. A scrubbing motion is used to apply CHG **and** the prep is allowed to completely dry. If CHG is contraindicated an appropriate substitute is used.	☐ Yes	☐ No	☐ Yes	☐ No		
IP7.*	Sterile gauze, sterile transparent, or sterile semi-permeable dressing is used to cover the catheter site.	☐ Yes	☐ No	☐ Yes	☐ No		
IP8.	A CHG-impregnated sponge is applied around the insertion site of the central line.	☐ Yes	☐ No	☐ Yes	☐ No		

# of Correct Practice Observed ("# Yes"): _____

Total # Central Line Insertion Observations ("# Observed"): _____
(Up to 16 total)
If practice could not be observed (i.e. cell is blank), do not count in total # Observed

Adherence _____%
(Total "# Yes" ÷ Total "# Observed") x 100

All 5 Core Elements are in place for all patients/residents observed: ☐ Yes ☐ No

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APPENDIX III:
EXAMPLE OF A CVC MAINTENANCE AUDIT/MONITORING FORM

Associated Hospital/Organization: Associated Organization: CDPH Public Health

Purpose of Tool: Can be used to audit CVC maintenance practice.

Healthcare-Associated Infections Program Adherence Monitoring
Central Line Maintenance Practices

Assessment completed by:
Date:
Unit:

Regular monitoring with feedback of results to staff can improve adherence to central line maintenance practices. Use this tool to identify gaps and opportunities for improvement. Monitoring may be performed in any type of patient care location where central lines are used.

Instructions: Use this tool to evaluate patients/residents with a central line. Review documentation and observe tubing and condition of dressings. Observe each practice and check a box if adherent, Yes or No. In the column on the right, record the total number of "Yes" for adherent practices observed and the total number of observations ("Yes" + "No"). Calculate adherence percentage in the bottom row.

Practices denoted by an asterisk (*) are considered core strategies and should be correctly practiced at all times.

	Central Line Maintenance Practices	Patient/ Resident 1		Patient/ Resident 2		Patient/ Resident 3		Patient/ Resident 4		Adherence by Task	
										# Yes	# Observed
D1.	The central line insertion date is documented. (May require chart review.)	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D2.*	Dressings that are wet, soiled, or dislodged are changed promptly.	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D3.*	The need for the central line is assessed daily by a practitioner, with prompt removal of unnecessary lines. (May require chart review.)	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D4.*	The optimal site is selected, avoiding the femoral site in adult patients.	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D5.*	Sterile gauze, sterile transparent or sterile semi-permeable dressing used to cover the catheter site is in place for ≤ 7 days (Mark "No" if no date on the dressing.)	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D6.	Antiseptic-containing protector caps are utilized for all line connectors if facility policy.	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D7.	A CHG-impregnated sponge is applied around the insertion site of the central line.	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D8.	Tubing and administration set have been in place for ≤ 7 days. (Mark "No" if no date on dressing.)	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D9.	If receiving TPN/Lipids, tubing is dated to ensure change every 24 hours.	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		
D10.	Daily bathing with a 2% CHG solution is done if facility policy. (May require chart review.)	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No	☐ Yes	☐ No		

# of Correct Practice Observed ("# Yes"): ___

Total # Central Line Maintenance Observations ("# Observed"): _____
(Up to 40 total)
If practice could not be observed (i.e. cell is blank), do not count in total # Observed

Adherence _____%
(Total "# Yes" ÷ Total "# Observed") x 100

All 4 Core Elements are in place for all patients/residents observed: ☐ Yes ☐ No

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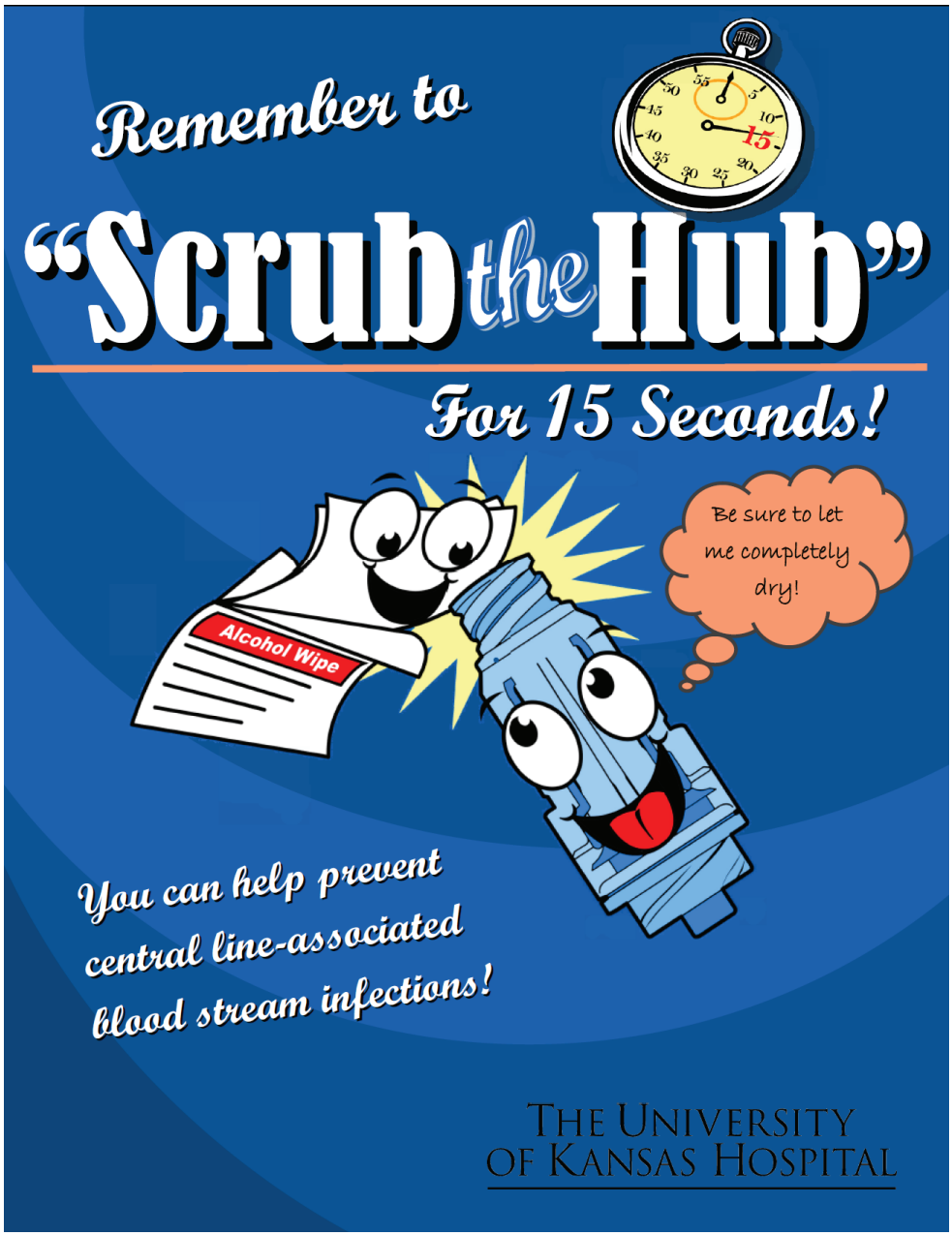
APPENDIX IV:
EXAMPLE OF A SCRUB THE HUB FLIER

Associated Hospital/Organization: University of Kansas Hospital in Kansas City, Kansas

Purpose of Tool: To promote line access disinfecting.



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